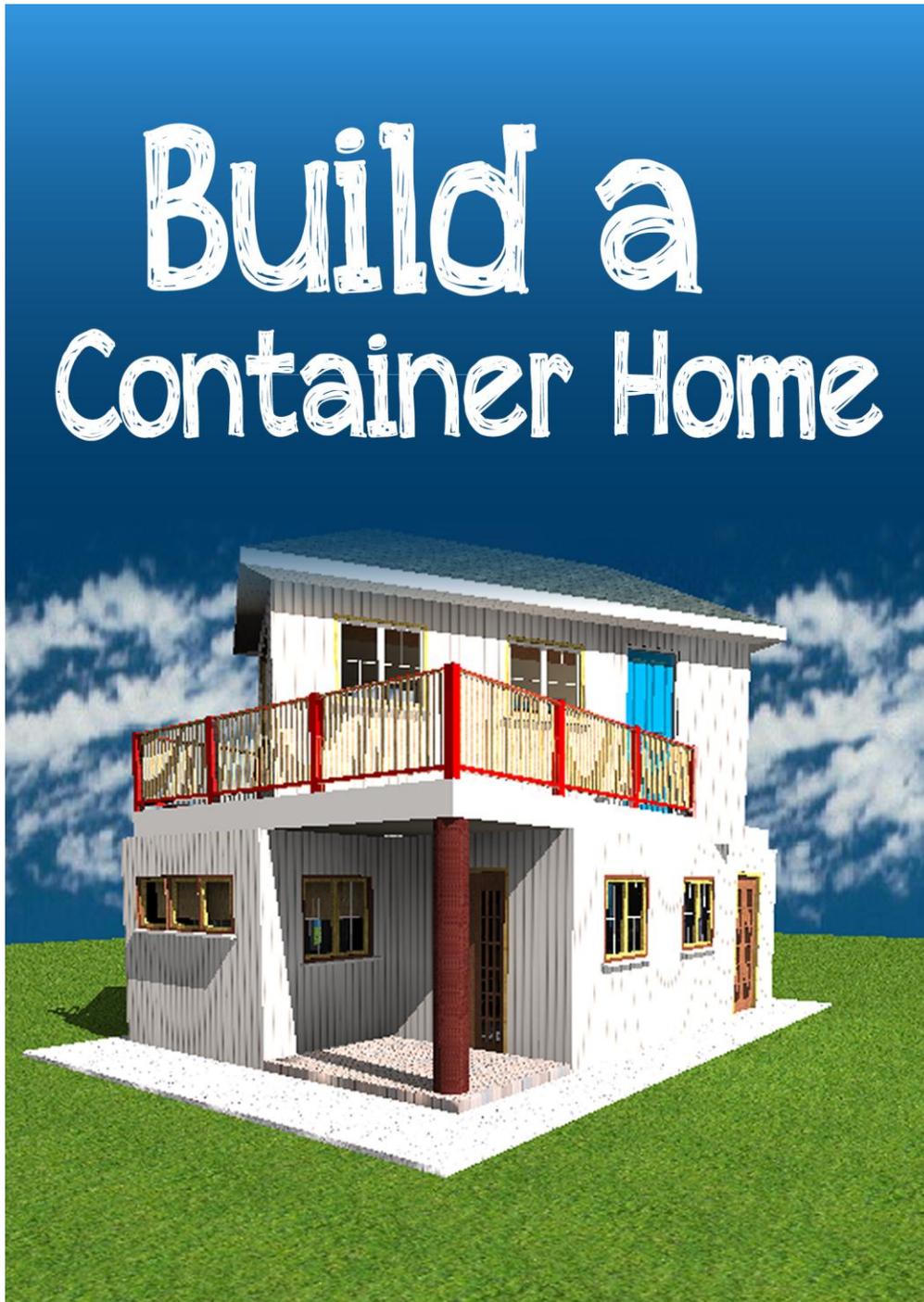


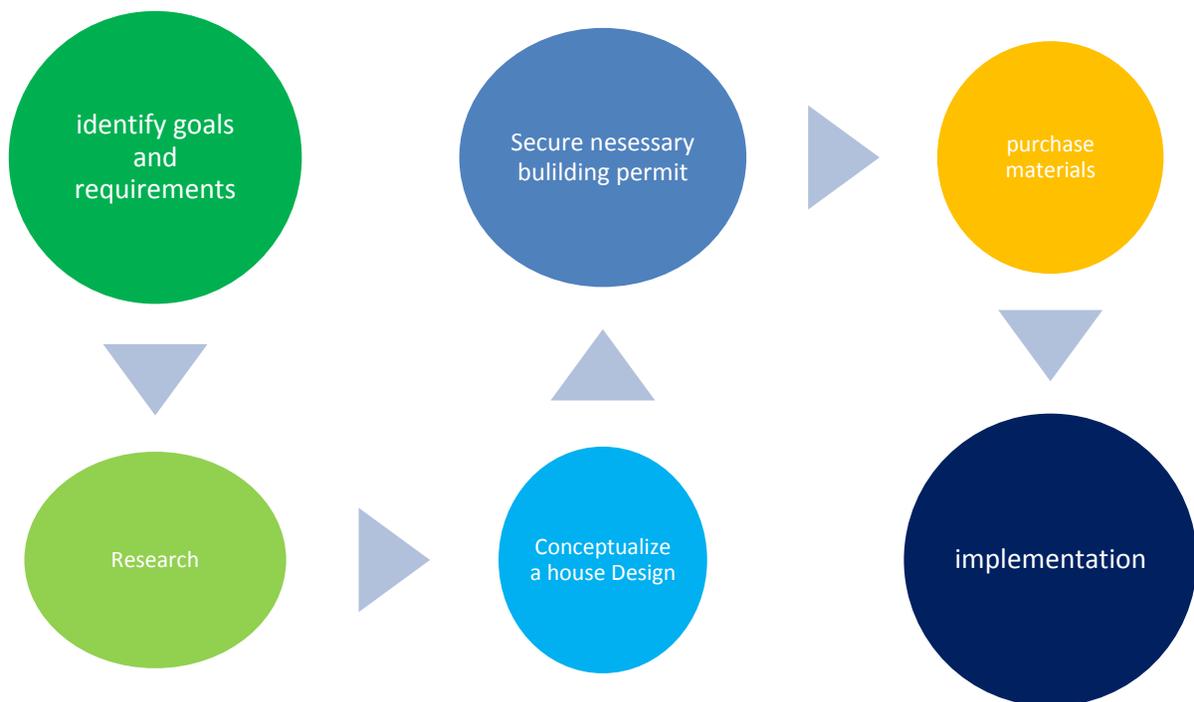
# Build a Container Home



## A guide in container house

Since you are interested in container house, you might have thought of building one either for you or for someone else. Container house has been increasing popularity today since its inception. This guide will help you in the most comprehensive way possible to make your projects come to reality. Information was gathered through extensive research and then illustrated. It provides necessary information from start to finish plus 25 sample container house designs to choose.

The diagram below illustrates the design process of building a container house.



Design process flowchart

From <http://www.zl6qh.com/000465.html>

## **Consolidating the plan**

Go back to diagram above in constructing your project container house. Planning is very essential in our entire endeavor. Good planning increases our chances of getting success it is said that 90% of all architectural building constructed is attributed to good planning.

First, you to Establish planning and design goals. Define and evaluate space requirements. Review benchmark standards, codes, and guidelines. Here is the checklist of this to do:

- How many people will used the house
- What is the style/ overall feel of your house
- What is your minimum and maximum budget for the project
- What place is your building construction project located.
- What are the requirements for the building
- Review site and soil bearing capacity.
- Determine the binding code and review.
- Determine if required professional services.
- Prepare project budget.
- Detail all program requirements - number of bedrooms, baths, home office, etc and determine rough square footage of each.
- Develop schematic design - including container massing configuration, floor plans, and elevations.

- Locate local or regional shipping container re-sellers and shops capable of performing modifications and interior fit-outs.

In Australia, Vitalmark constructions posted these building permit requirements on their site, Getting a Building Permit:

### **Why do I need a permit?**

All major building work carried out in Australia requires a permit issued by the local Council. Building without a permit can result in heavy fines.

### **Who gets the permit?**

In most cases your builder will obtain all the proper permits required for your building to commence. However you may wish to manage this part of the process yourself.

Whatever the choice, the owner is liable for all costs relating to the permit, and allocation of the process should be clearly stipulated in the building contract.

### **The Permit Checklist**

Getting your building permit is the first real step towards construction, but before you make that step you'll need to take many little steps gathering together the following documentation.

The overall form:

- A completed Application form
- Payments
  - Building Fee
  - Lodgement Fee
  - Crossing Deposit
  - Inspection Fee
  - Government Levy

Information relating to your property

- Certificate of title for your property, a copy is available from the Titles Office
- Proof of your ownership of the property OR proof that you are purchasing the property under Section 9AA of the Sale of Land Act 1962
- full details of services in any easement
- 45 degree Angle of Repose details

- any approval issued by a relevant Authority (eg heritage body, VicCode) for works on the property
- final Town Planning agreement

#### Information relating to the building works

- Housing Guarantee Fund registration (form 10)
- 3 sets of an allotment plan to a scale of 1:500 or more
- 3 sets of fully-dimensioned working drawings
- 3 sets of builders' specifications
- AS1684,1992 compliant Timber frame and bracing design
- 3 sets of truss computations & layouts
- 3 sets of structural Engineers' computations
- 3 sets of Engineers' Report of existing conditions for Footing system & structural frame elements
- 3 sets of Energy Rating Report
- 3 sets of Soil Report
- details of any proposed work required for protection of persons & public property

Note:

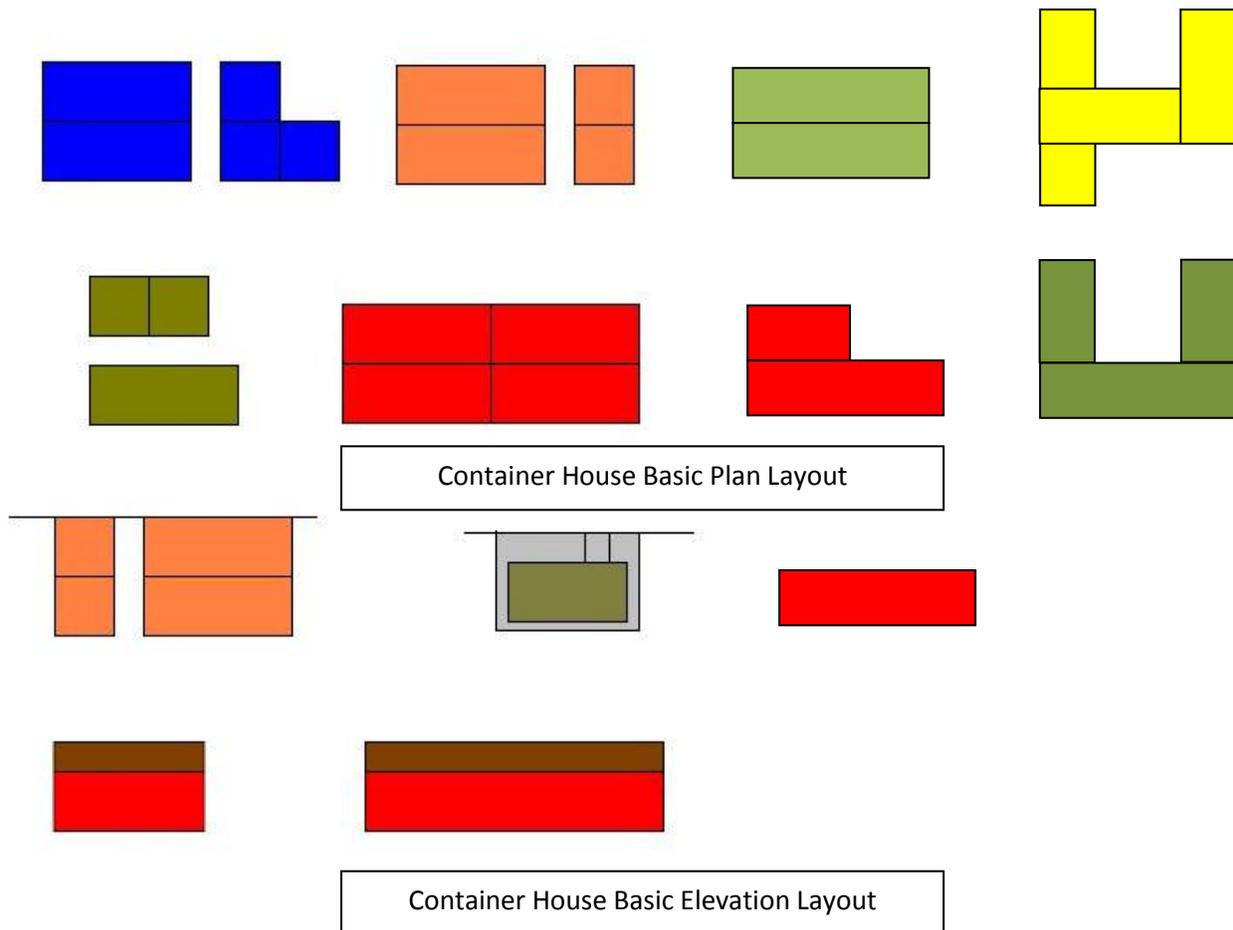
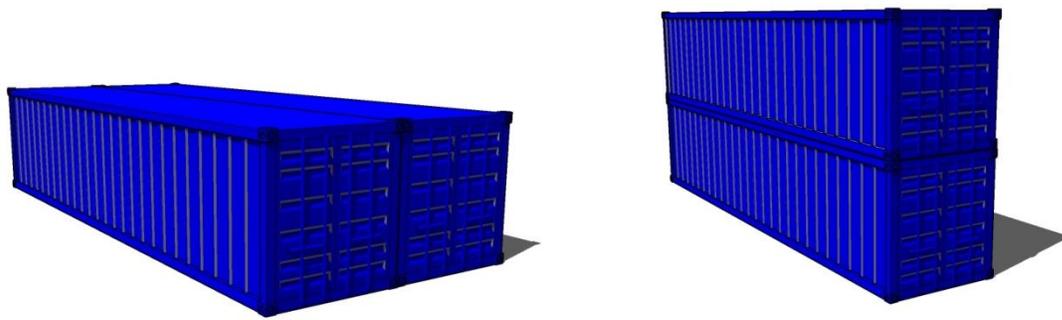
Other countries vary on some degree of documents required in applying building permits.

### III. Getting to work

Here we will talk about how to set-up your own container house assuming that you have completed the task in setting your objectives and the necessary permits to establish your own container house.

First,

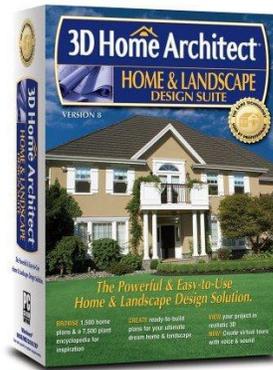
We will take a design layout for your container house. The illustration below illustrated the most common container house to consider. But, of course you can still make your own design.



On above layout we will take 2 40 footer ISO container. This will be enough to give us a 2 bedroom, 1 bathroom, a living and dining room.

You can used traditional way of lay outing foundation or through the aid of computer aided design. If you consider using traditional method (pencil and paper) a sketch drawing will do. Then when you have the initial layout out you can continue draw its initial floor plan design. In this case it will be much easier if you will used Computer Assisted Design Software such as 3d homes Architect, Punch home design or sketch up.

For easy visualization and faster rendition of your house design, the first two software will of much ease. The software thou design for building wooden or concrete houses yet you can make used of it's many features to come up with the design of your container house. After all container house is also an architectural structures. Using these software you do not need to worry about architectural standard since it is basically provided in the software's.

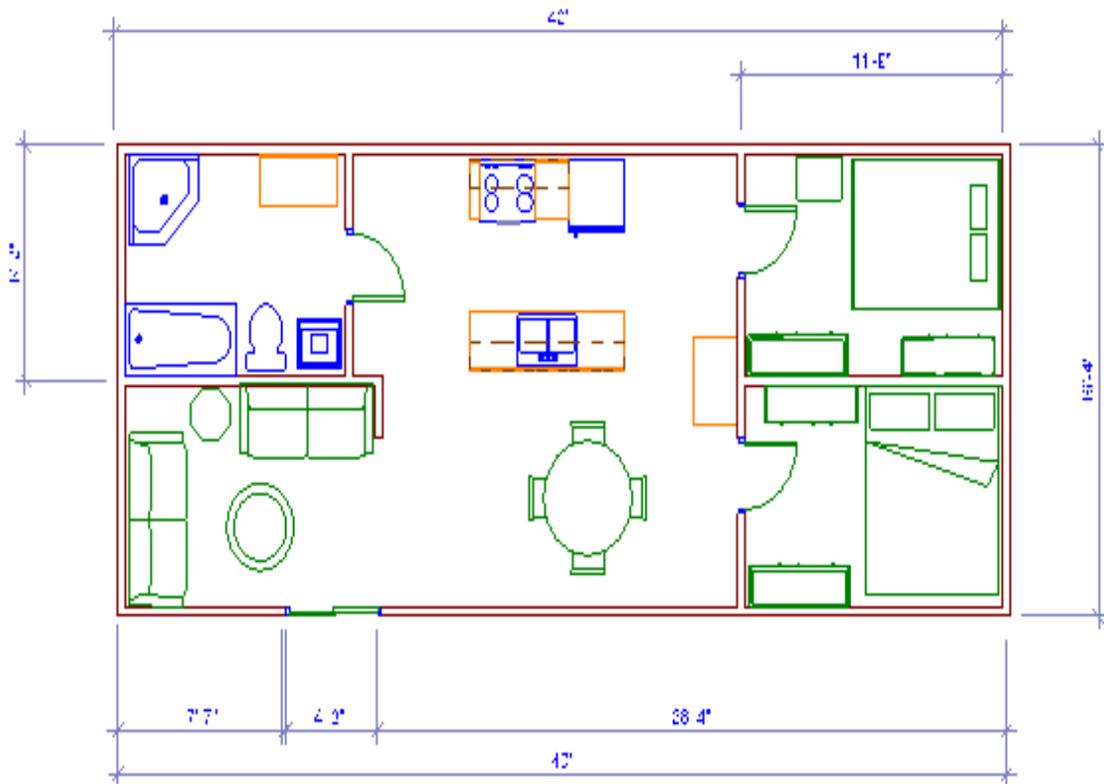


3d Designing Software's can be used for container house design

Example Model Home Plan

Approximate Dimensions and Surface

640 sf 2 Bedroom



House Plan

Small residential house

Standard Container Units

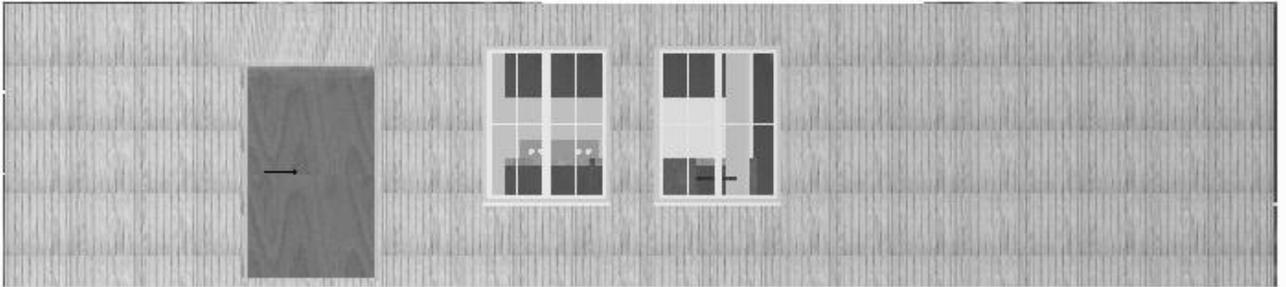
Approximate Dimensions and Surface Areas

Container Dimensions	Length	Width	Height	Floor Area	Roof Panel	Left.Side Wall Panel	Right Side Wall Panel	Back Wall Panel	Front Doors
20' High Cube	20ft	8ft	9.5ft	160 s.f.	160 s.f.	190 s.a.	190 s.a.	76 s.a.	76 s.a.
20' Standard Cube	20ft	8ft	8.5ft	160 s.f.	160 s.f.	170 s.a.	170 s.a.	68 s.a.	68 s.a.
40' High Cube	40ft	8ft	9.5ft	320 s.f.	320 s.f.	380 s.a.	380 s.a.	76 s.a.	76 s.a.
40' Standard Cube	40ft	8ft	8.5ft	320 s.f.	320 s.f.	340 s.a.	340 s.a.	68 s.a.	68 s.a.

The table above indicates the calculated space for ISO container. Those surfaced area will be useful in calculating space divisions for different areas in the house.

House Elevations

Door and window must be



Front Elevation

### **Site preparation:**

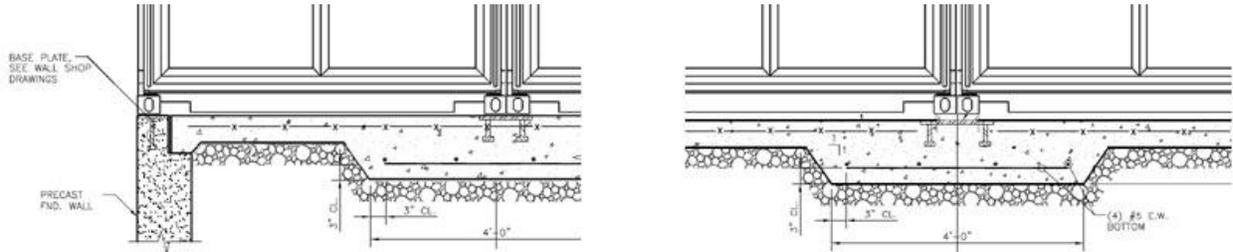
Before you purchase your container, it is wise to prepare the site first. This includes cleaning the site, flattening the area where you will place the containers. For flattening the area we can use the pounding tool or you can just use flat boards for flattening. Flattening activity is most useful when using slab foundation but still looks well for just concrete footings. Anyways, after preparing the site we can now proceed in laying the foundation.

For a 40-foot shipping container house:

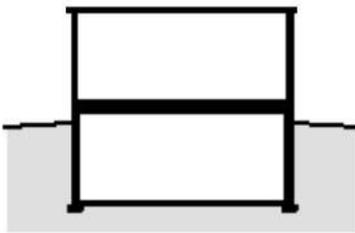
To build the foundation for 40-foot container buildings may differ in style depending on its advantages. What are most used are the concrete blocks for shipping containers, but they have to be reinforced with rebar. A pin foundation can also be used because it is more environment-friendly.



A typical slab on grade application for a 1000sf (three 40' containers) **shipping container home** design can be a very good foundation. A perimeter foundation wall of 24' x 40' made from precast concrete panels. Drainage system at the perimeter has to be excavated and trench is to be filled with gravel. These precast panels were to be dropped via crane tied together including insulation with exterior water proofing membranes. The respective locations in plan of utilities (water, electrical, and gas supply lines) are run to the base of the foundation. There should be back-fillings, soil compacted, gravel added, rebar lay out and then slab poured in the foundation walls.



### Other types of foundations



A: DEEP BASEMENT



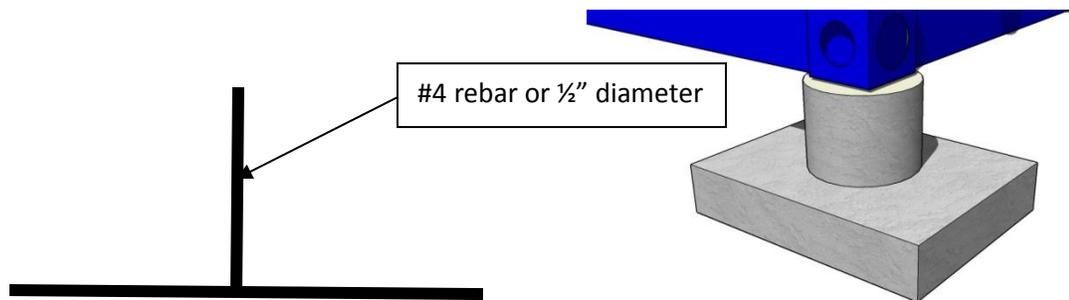
B: CRAWL SPACE



C: SLAB-ON-GRADE

Using simple footings

For the sample project above we can use simple footings instead of a concrete slab.



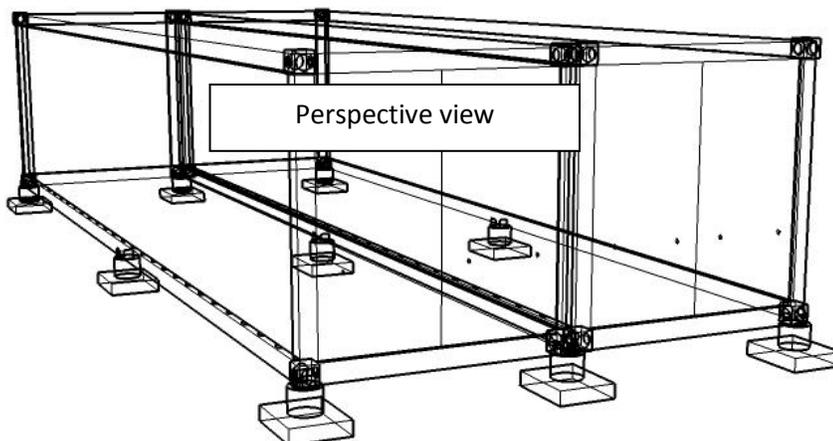
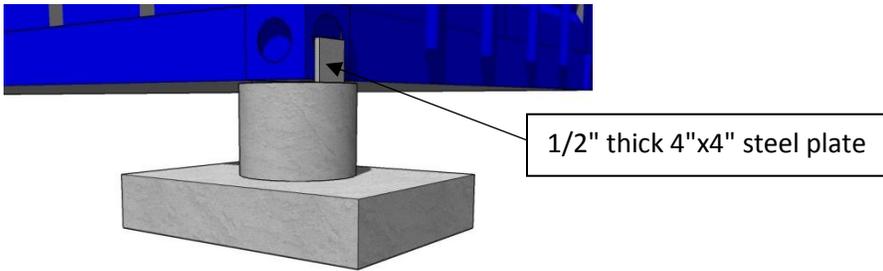


36"x36" and 16"  
footing

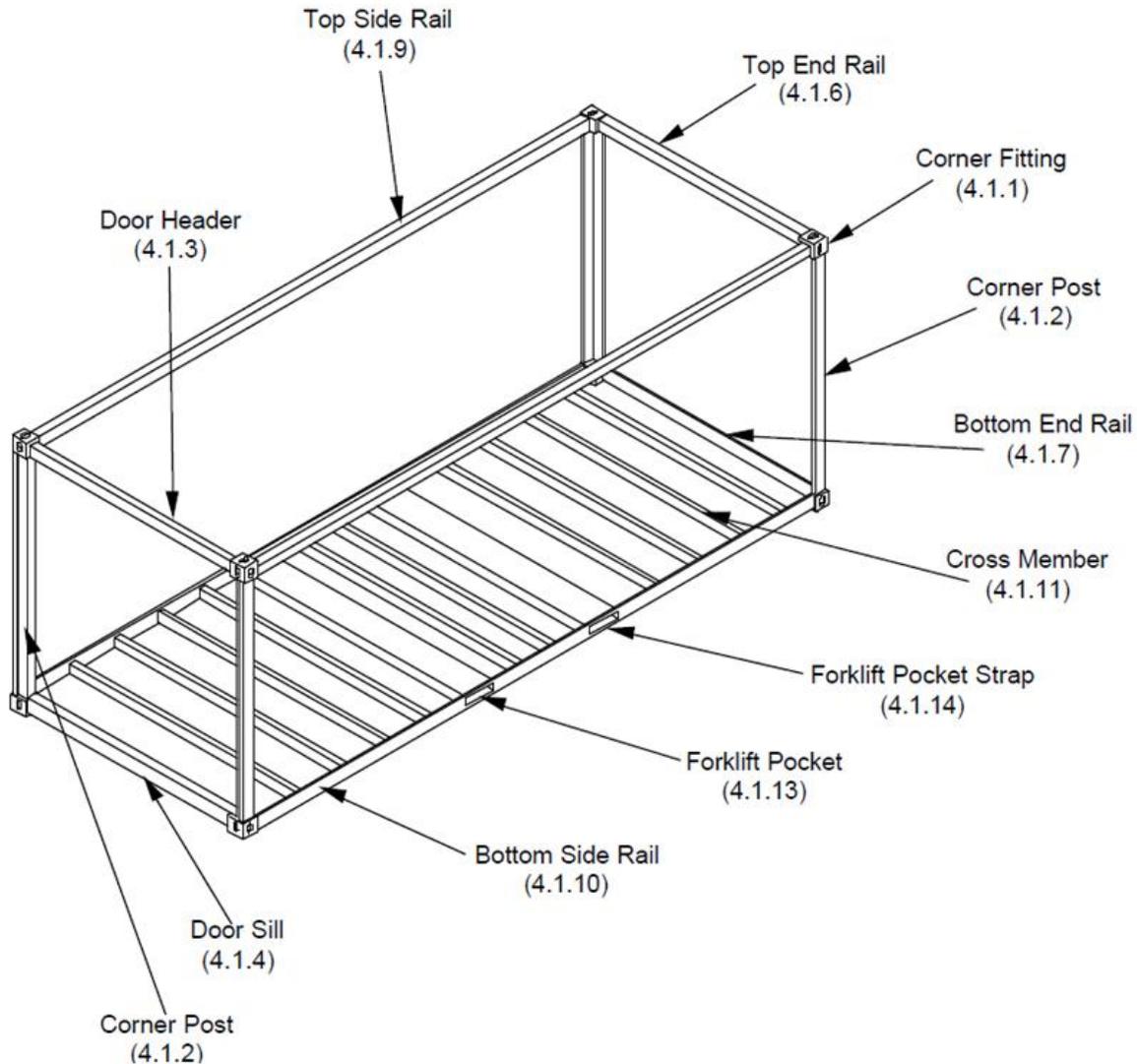
The minimum footing size we can use is for a corner footing is 24"x24" and 16" deep. Where two containers are joined the footing underneath that point should be 36"x36" and 16" deep. At any point that the structure must be supported with an internal column you must support the point load with another

24" square footing.

Adding #4 rebar that is 1/2" thick will make the footing stronger. Your going to want to form up two squares per footing about 8" above one another and at least 3" clear of the soil.



## Understanding the ISO container



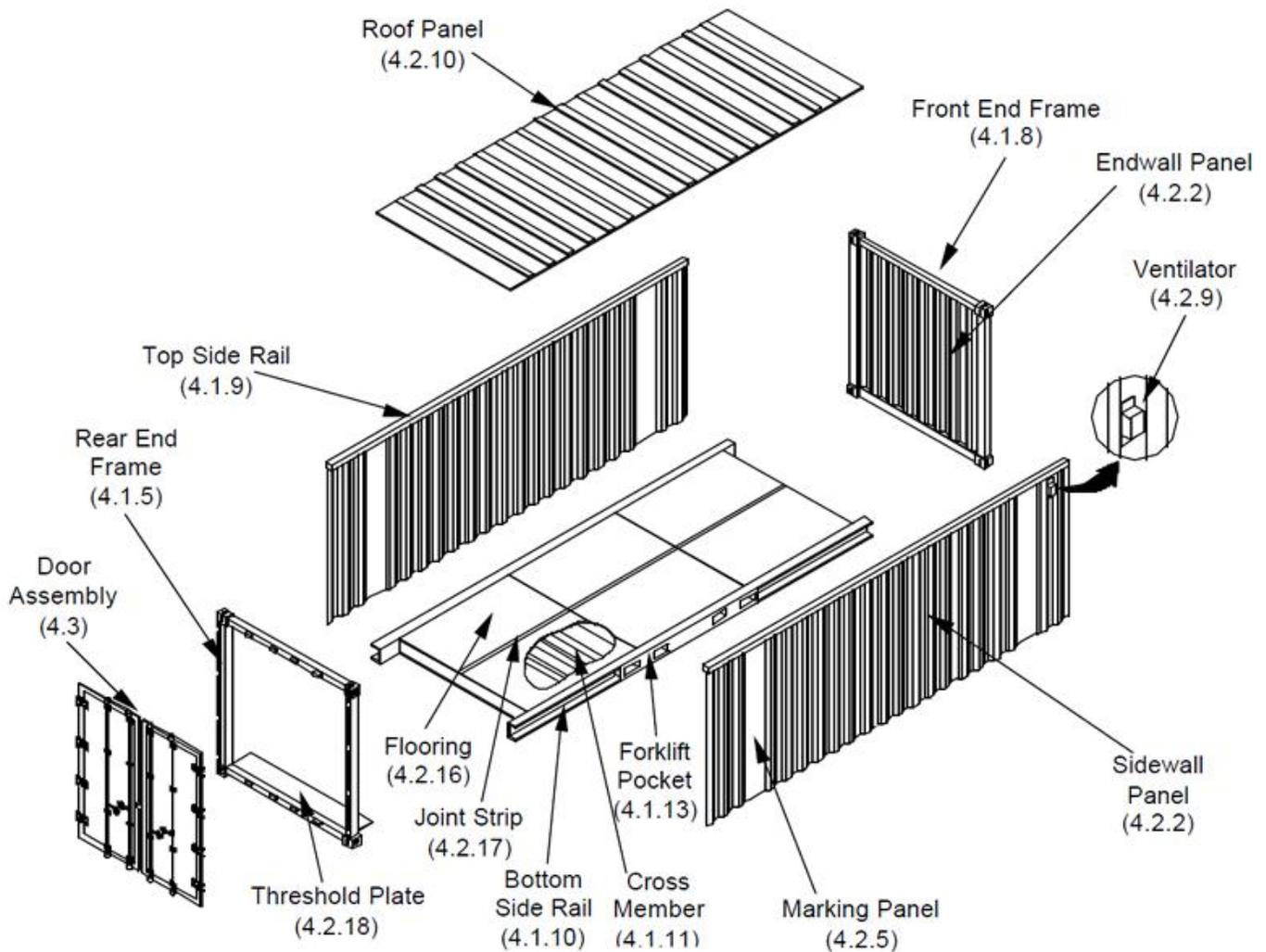
**Figure 1 Primary Structural Components for a Typical 20' ISO Shipping Container.**

Note: On some ISO shelters, some of the primary structural components may be concealed within the wall, roof, and floor panels. The areas where the adjacent panels join will be thoroughly inspected. This inspection will meet the criteria for the Wall Beams and the Roof Beams.

- 4.1.1 **Corner Fitting.** Internationally standard fitting (casting) located at the eight corners of the container structure to provide means of handling, stacking and securing containers. Specifications are defined in ISO 1161.
- 4.1.2 **Corner Post.** Vertical structural member located at the four corners of the container and to which the corner fittings are joined.
- 4.1.3 **Door Header.** Lateral structural member situated over the door opening and joined to the corner fittings in the door end frame.

- 4.1.4 **Door Sill.** Lateral structural member at the bottom of the door opening and joined to the corner fittings in the door end frame.
- 4.1.5 **Rear End Frame.** The structural assembly at the rear (door end) of the container consisting of the door sill and header joined at the rear corner fittings to the rear corner posts to form the door opening.
- 4.1.6 **Top End Rail.** Lateral structural member situated at the top edge of the front end (opposite the door end) of the container and joined to the corner fittings.
- 4.1.7 **Bottom End Rail.** Lateral structural member situated at the bottom edge of the front end (opposite the door end) of the container and joined to the corner fittings.
- 4.1.8 **Front End Frame.** The structural assembly at the front end (opposite the door end) of the container consisting of top and bottom end rails joined at the front corner fittings to the front corner posts.
- 4.1.9 **Top Side Rail.** Longitudinal structural member situated at the top edge of each side of the container and joined to the corner fittings of the end frames.
- 4.1.10 **Bottom Side Rail.** Longitudinal structural member situated at the bottom edge of each side of the container and joined to the corner fittings to form a part of the understructure.
- 4.1.11 **Cross Member.** Lateral structural member attached to the bottom side rails that supports the
  - flooring.
- 4.1.12 **Understructure.** An assembly consisting of bottom side and end rails, door sill (when applicable), cross members and forklift pockets.
- 4.1.13 **Forklift Pocket.** Reinforced tunnel (installed in pairs) situated transversely across the understructure and providing openings in the bottom side rails at ISO prescribed positions to enable either empty capacity or empty and loaded capacity container handling by forklift equipment.
- 4.1.14 **Forklift Pocket Strap.** The plate welded to the bottom of each forklift pocket opening or part of bottom siderail. The forklift pocket strap is a component of the forklift pocket.
- 4.1.15 **Gooseneck Tunnel.** Recessed area in the forward portion of the understructure to accommodate transport by a gooseneck chassis. This feature is more common in forty foot and longer containers.

**Figure 4.2 Exploded axonometric view of a Typical 20' ISO Shipping Container .**



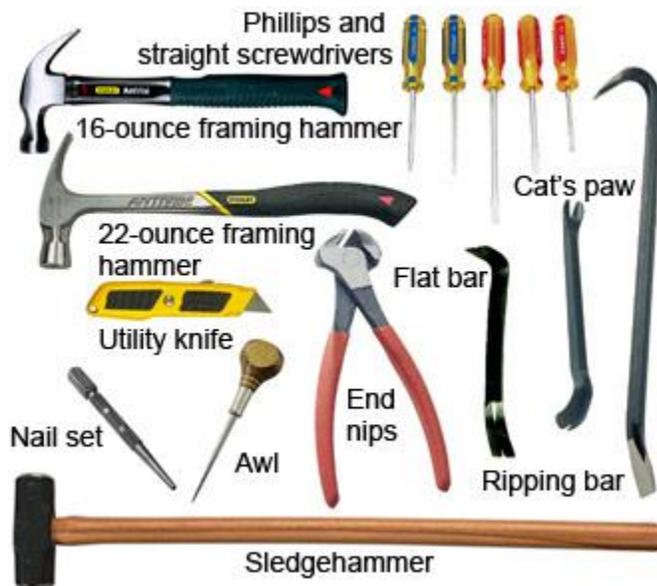
- **4.2 Walls, Roof, and Floor.** Refer to Figure 4.2A
- **4.2.1 Fiberglass Reinforced Plywood (FRP).** A material constructed of laminates of fiberglass, polyester resins, and plywood, also known as sandwich panel.
- **4.2.2 Wall Panel.** Corrugated or flat sheet steel, a riveted or bonded aluminum sheet and wall post assembly, FRP, foam and beam, aluminum, or honeycomb material that forms the side wall or end wall.
- **4.2.3 Wall Post.** Interior or exterior intermediate vertical component to which sheet aluminum or steel is riveted or welded to form a wall panel.
- **4.2.4 Wall Beam.** Encapsulated vertical component to which sheet aluminum or steel is bonded to form a wall panel. This is found in foam and beam panels.
- **4.2.5 Marking Panel.** A side wall panel of a corrugated steel configured with a flat portion used for the display of markings and placards. (4.2A)

- 4.2.6 **Lining.** Plywood or other like material attached to the interior side and end wall to protect the walls and/or cargo and facilitate loading operations.
- 4.2.7 **Lining Shield.** A strip of thin metal installed at the bottom of the interior walls to protect the lower portion of the lining from damage by materials handling equipment during loading or unloading operations.
- 4.2.8 **Kick Plate.** A common name for a lining shield installed on the lower portion of the interior front end wall.
- 4.2.9 **Ventilator.** Two or more devices permanently attached to the side or end wall panel that provides openings for the exchange of air (but not water) between the outside and the container interior. (4.2A)
- 4.2.10 **Roof Panel.** Corrugated or flat sheet steel, sheet aluminum, FRP, or foam and beam and aluminum honeycomb panel that forms the top closure of the container. (4.2A,)
- 4.2.11 **Roof Bow.** Lateral non-structural member attached to the top side rails and supporting the underside of the roof panel. Roof bows used with removable cover (tarp) assembly are unattached. Not all container designs require roof bows.
- 4.2.12 **Roof Beam.** Encapsulated horizontal component to which sheet aluminum or steel is bonded to form a roof panel.
- 4.2.13 **Roof Reinforcement Plate.** An additional metal plate on the interior or exterior of the roof panel adjacent to the top corner fittings that provides protection of the roof panel or top rail components from misaligned handling equipment.
- 4.2.14 **Tarp.** Jargon for "tarpaulin" which is a waterproof and flexible fabric used for covering the top of an open-top container. This covering is referred to as a "Tilt" in some countries.
- 4.2.15 **TIR Cable.** Plastic sheathed wire rope that is designed in accordance with TIR customs convention (Refer to paragraph 4.5.6) and is threaded through the welded loops on the sides, end panels and door panels of an open-top container to secure the tarp.
- 4.2.16 **Flooring.** Material that is supported by the cross members and bottom rails to form a load bearing surface for the cargo. The flooring is usually constructed of laminated wood planks, plywood sheets, or other composition material and is screwed or bolted to the cross members. Some containers have welded steel or aluminum flooring, sandwich panels or a combination of metal and wood. (4.2A)
- 4.2.17 **Joint Strip.** A formed steel or aluminum strip (usually hat-shaped section) installed between joints of the plywood sheet flooring or joints of the plywood sheet lining to help integrate and support the edges of the plywood. (4.2A)
- 4.2.18 **Threshold plate.** Plate forward of the door sill to protect the entrance area of the container floor. This plate is commonly referred to as a crash plate.
- 4.2.19 **Steps.** Folding steps are found on some ISO Shelters and are used to gain access to the roof. They must be folded up prior to transporting shelter.
- 4.2.20 **Sandwich Panel.** A type of fixed or removable panel construction used in ISO Shelters consisting of a thin inner and outer sheet aluminum skin, bonded or fastened to a core constructed of either honeycomb or structural foam and aluminum beams.
- 4.2.21 **Striker Plate.** An additional metal plate on the exterior of the roof panel adjacent to the top corner fittings that provides protection to the roof panel or top rail components from misaligned handling equipment.

- 4.2.22 **Sling Pad.** An additional metal plate on the exterior of the roof panel located in the center of the roof panel that provides protection to the panel from lowered handling equipment.

**Install windows, exterior doors, flashing, and any sky lights.** Windows are set into openings that were measured and cut prior to delivery of the shipping containers or roughed out on site. All openings for windows and doors should be framed with a steel section. Hollow rectangle sections work the best, but an L section will work as well. Images below show openings for sliding door systems in the end and sidewall panels of a container.

### Things For DO-IT yourself Construction



cordless drill-driver



electric drill



examples of bits and drills [1]



examples of bits and drills [2]



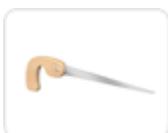
hand drill



brace



handsaw



Compass saw



Coping saw



Oxy-acetylene welding machine



Laser level

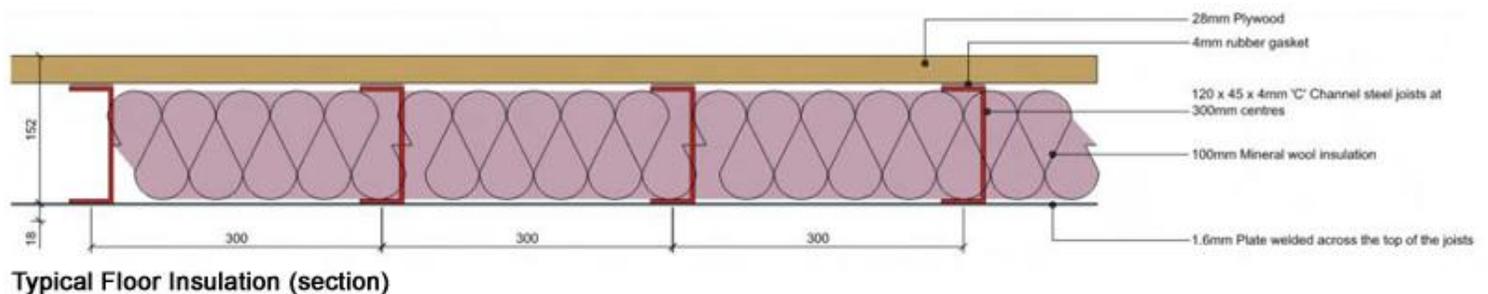
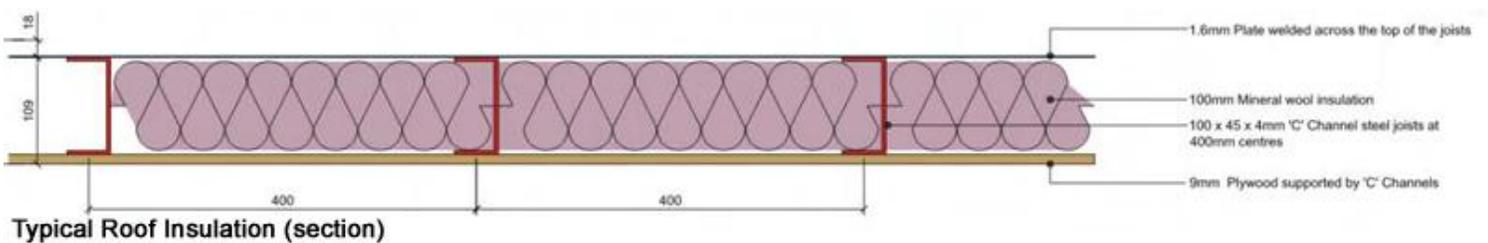
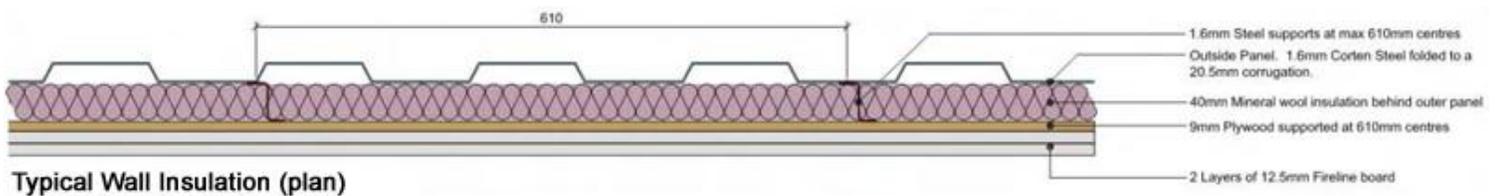
Don't forget this safety gear



1. Custom hard hat
2. Work gloves
3. Safety glasses
4. Safety vest
5. Mask
6. Earplugs



**Core Envelope** The exterior walls, ground floor, roof, and glazing make up the core envelope of a building. Energy code compliance and your site's location, thermal zone, and climate factor strongly here and will determine insulation requirements. Keeping the building warm in the winter and cool in the summer with minimal mechanical system help will do much



to drive down monthly utility costs These should be reviewed prior to developing/detailing the core envelope

The US Department of Energy has a fantastic tool ([REScheck](#)) to simplify and clarify code compliance with the Model Energy Code (MEC), the International Energy Conservation Code (IECC), and a number of state codes. You input the square footage of each core envelope

element (wall, roof, slab, etc.) and project location. This will determine the binding energy code and allow you to play with different R values (insulation levels) until the envelope design is in compliance and thereby setting the required R-values. Even if your project is small or not subject to energy code compliance, the REScheck exercise is worth the time.

The **R-Value Table** in the Reference Documents and Details section has different assembly R-values. Once you know the required R-values for the core envelope elements you can begin detailing. For illustration, consider a cold climate that requires an R-30 value for exterior walls. This could be achieved with batt (R 3.25 per inch ~ R30 would require 9-10"), foam panels (R 5 per inch ~ R30 would require 6"), and standard spray foam (R 6.75 per inch ~ R30 would require 4.5").

# R-Value Table

## Insulation Values For Selected Materials

Use the R-value table below to help you determine the R-value of your wall or ceiling assemblies. To obtain a wall or ceiling assembly R-value you must add the R-values of the individual components together.

## Calculating Assembly Wall R-Value

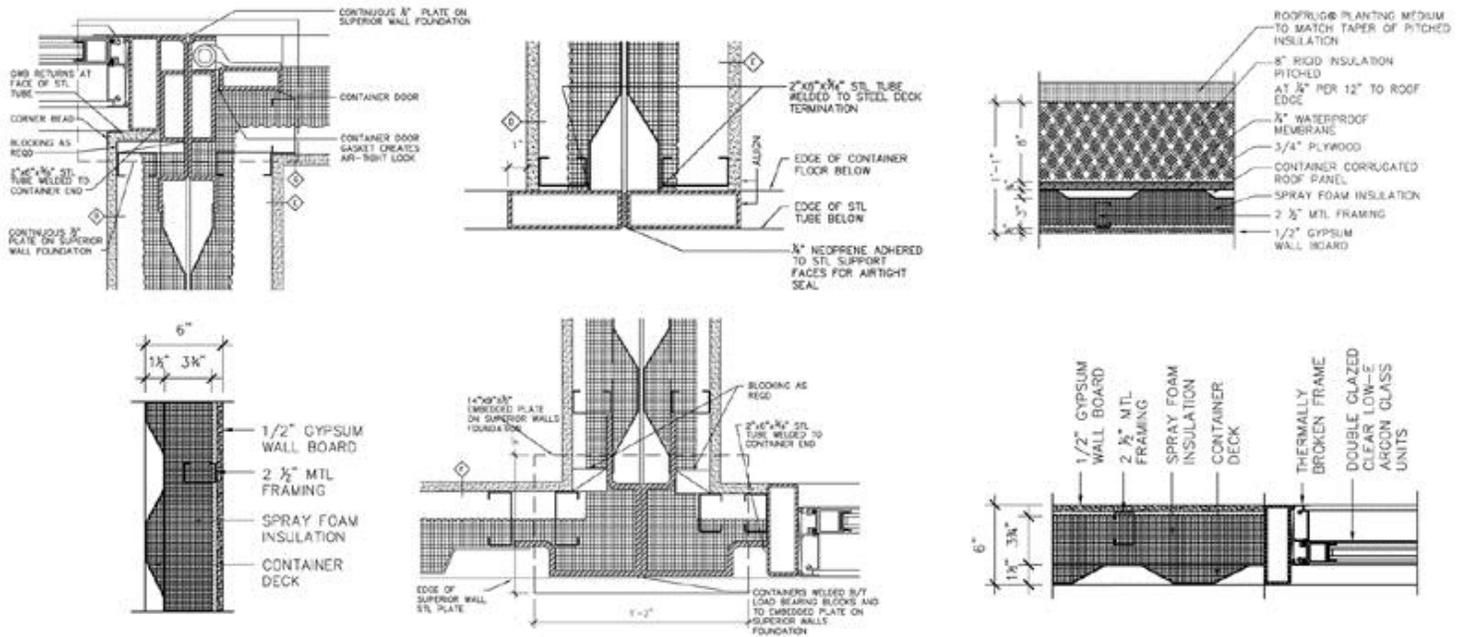
Formula: Assembly R-value = 1 / (Assembly U-value) = 1 / (U-studs x % + U-cavity x %)

Example Component Assembly	R-Value Studs	R-Value Cavity	Assembly R-Value
Wall - Outside Air Film	0.17	0.17	
Siding - Wood Bevel	0.80	0.80	
Container Side Wall Steel Corrugation"	0.33	0.33	
3 1/2" Fiberglass Batt		11.00	
3 1/2" Stud	4.38		
1/2" Drywall	0.45	0.45	
Inside Air Film	0.68	0.68	
Percent for 16" o.c. + Additional studs	15%	85%	
<b>Total Wall Component R-Values</b>	<b>7.12</b>	<b>13.73</b>	

Wall Component U-Values	0.1404	0.0728	
Total Wall Assembly R-Value			12.05

\* This example is just for wood frame construction. Steel studs are a more complicated calculation.

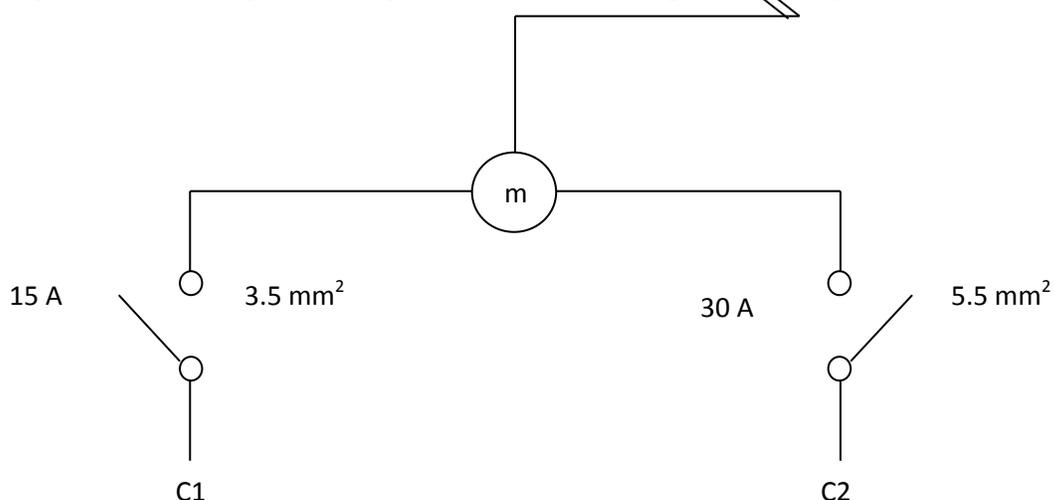
## Plan and Section Details



## ELECTRICAL INSTALLATION

### Electrical Layout

This simple electrical single line diagram will do for a simple one storey container house



## **Plumbing and electricity to a 40-foot ocean container building:**

Adding plumbing and electricity to a shipping container building is very expensive. It's wiser to purchase such shipping containers with electricity already. It is but of no difference than plumbing a normal home. There should be a separate line for lightings and outlet to avoid overload.

For our simple house construction sample here is the required tools needed:

Like any other project you may try to tackle, electrical work will require a few tools to accomplish the job. This is a partial list of needed tools to take care of most electrical jobs. These tools are readily available at most building material outlet stores or electrical wholesalers. Hopefully the descriptions below will help you in selecting the proper tools for the type of electrical projects you will encounter.

### **1. Fish Tape**



*Tim Thiele*

A fish tape is used to pull stranded or solid wire through metal or PVC conduit. Cable lube is available to assist you in pulling the wires through the pipe.

### **2. Tape Measure**



*Tim Thiele*

A tape measure is use to measure heights for switches and outlets. You will also need it to center lighting fixture boxes.

### **3. Voltmeter**

A voltmeter is used to check voltages and verify that circuits are indeed “live”.

#### 4. [Hammer](#)



*Tim Thiele*

A hammer is used to secure boxes equipped with nail-on brackets to studs in a home. You’ll also need it to drive Romex straps when adding new Romex wiring in a home.

#### 5. [Channel Lock Pliers](#)



*Tim Thiele*

Channel lock pliers are used to take knockouts out of the boxes, tighten down Romex connectors in the boxes, and adjust expansion-type ceiling-fan boxes.

#### 6. [Wire Strippers](#)



*Tim Thiele*

Wire strippers are used to cut the insulation off of the wire. They are equipped with different sized cutting teeth for various sized wires. They also have a cutoff portion in order to cut the wire.

## 7. Non-contact Voltage Detector



*Tim Thiele*

A voltage detector is used for a quick safety check to see if there is voltage or current flow present. Some of these devices are automatic and some must be turned on via a switch. Simply place the end of the tracer beside a wire, breaker or cord to see if it's energized.

## 8. Side Cutter Diagonal Pliers



*Tim Thiele*

These cutting pliers, sometimes called side snips, are used to cut wire. They are specially designed with a cutting edge that goes down to the tip of the pliers. The advantage being that you can get into tight areas to trim wires. There are some that are equipped with live wire detection capabilities.

## 9. Linesman Pliers



*Tim Thiele*

These pliers are the do-it-all pliers. They cut, twist wires together, and grip wires for pulling. They have a squared off end that is great for twisting wires together, a center cutting blade for cutting wire, and a grip area between the handles to pull wire.

## 10. Torpedo Level



Tim Thiele

A level is used to make sure your work is level and plumb. A great installation starts with straight switch and outlet covers.

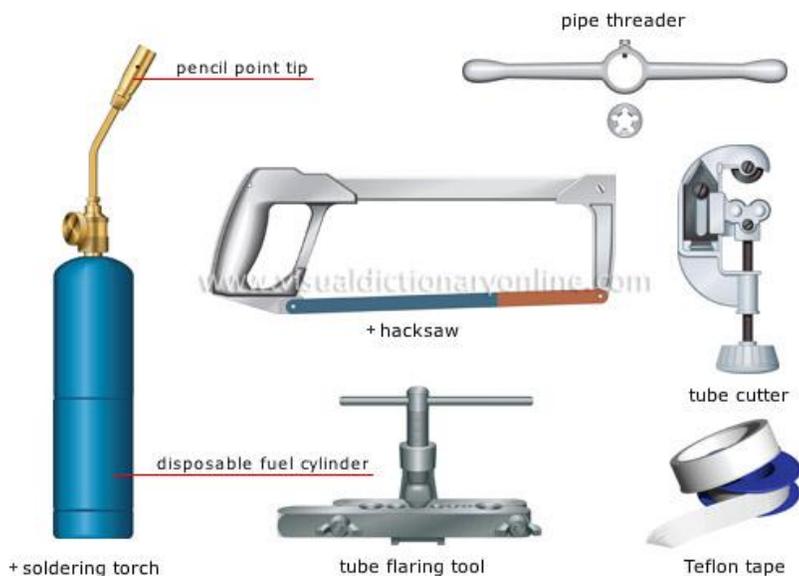
**Install interior framing, insulation, heating and cooling systems, plumbing, electrical, and rough out all fixtures.** Supertherm insulative coating, is sprayed on both sides of the remaining container walls. Supertherm is a high-performance, four-part ceramic coating that carries an R value of R-19 and adheres to the steel surface of the shipping containers. A ½-inch plywood floor over the existing ¾-inch plywood sub-floor is installed. Metal hat channels for wiring are run along the walls and vertical support beams are secured. Metal studs and drywall are used for interior partition walls. Once insulated, the existing container walls are faced in drywall for finishing.

## Installing Plumbing

40-foot cargo container building-maintenance:

A first-rate paint job must be applied to Steel buildings because we know they will rust. Others worry about having a house that looks like a matchbox; all they have to do is to add stucco exteriors. By this, it will not only lessen its appearance of being a box it also requires less effort of painting and repainting.

### Plumbing tools needed



Here is some PEX, the brass fittings, crimps, and the crimping tool:



Blue for cold, red for hot. Same stuff, just color coded for easier identification .

Here's the toilet stub-up:



You can warm PEX with a torch, bend it, and it will keep its new shape. I welded two pipe clamps to the side of the container. Later, this bathroom wall will get Plycem. That and the concrete slab will hide the plumbing. The PEX, the PVC electrical conduit, and the PVC water pipes can shears



Note:

Always observe safety operating procedure like wearing protective gloves, goggles, working booths and etc.

Remember first precaution is better than cure.

<http://panamashippingcontainerhouse.com/%20interior-walls-wiring-plumbing-projects-in-progress>

### **For Ceiling Installations:**

For easy construction and convenience the use of suspended ceiling is quit popular now days. For our simple container house plan we can use t-runner. Advantage of this is that ducts, pipes and cables hidden above a dropped ceiling remain accessible for repair or modification. And second, suspended ceilings are better sound barriers than drywall ceilings. In

<http://www.popularmechanics.com> the following are derived information on How To Install A Suspended Ceiling:

1. We need at least 7 1/2-ft. ceiling height in new construction
2. Typical systems have an L-shaped perimeter bracket, or molding, to support the suspended ceiling at the walls.
  - From this molding, long stringers, called main runners, are installed every 4 ft. and run the length of the room. The ends of the main runners rest on the perimeter moldings and everything in between is suspended with wires secured to the joists above.
3. Cross tees are installed across these runners at intervals of 24 in. This grid is all that's needed to support 2 x 4-ft. ceiling panels.
  - With 2 x 2-ft. panels, an additional set of connectors divides each 2 x 4-ft. area.



## Installation of Septic Tank

New innovations in the use of new materials for septic tank are now increasingly used. This type of septic tank is quite affordable and convenient to install than constructing a typical septic tank made of concrete. This is what we call plastic septic tanks.



According to [www.damnseptic-tank.com](http://www.damnseptic-tank.com) these are the advantages and disadvantages of plastic septic tank

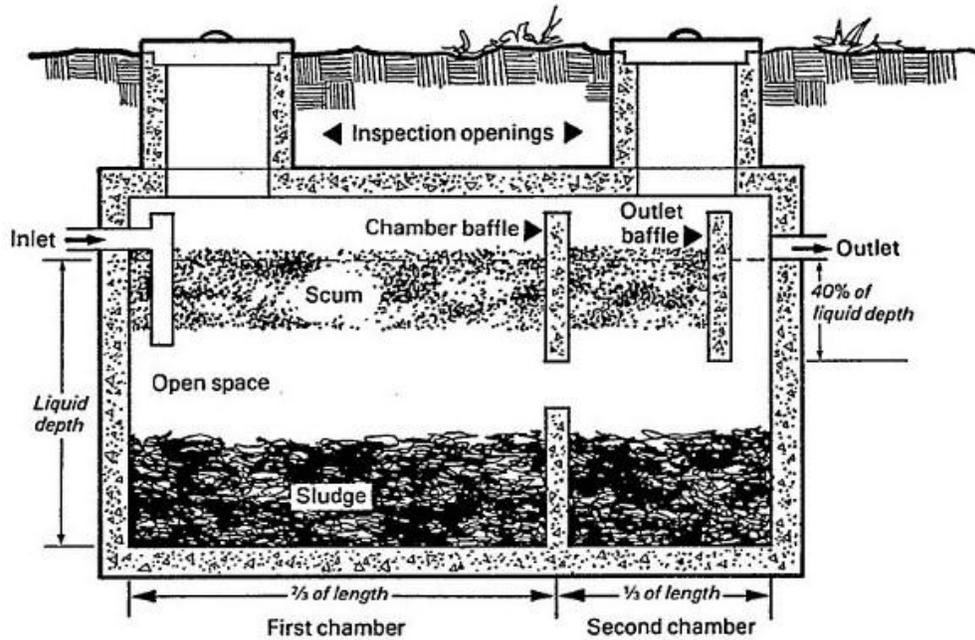
- Plastic septic tanks are far less prone to cracking than other options on the market
- Plastic septic tanks weigh less than any other type of septic tank and so they are easily maneuvered around a property and installed
- Plastic septic tanks are some of the most inexpensive on the market
- Since there are no metallic parts, plastic septic tanks do not rust
- Plastic septic tanks do not corrode and are completely water-tight

### Plastic Septic Tank Disadvantages

- Plastic septic tanks are so light that they will 'float' on the surface of the ground if they are not installed correctly
- The effluent level is usually lower in a plastic septic tank, which you will only discover while having your septic tank pumped
- Not all states allow the installation of plastic septic tanks (it is best to ask your City Hall)
- Damage to your plastic septic tank can occur during installation because it is so light-weight

Note: Check your local city hall if plastic septic tank is allowed in location

If plastic septic tank is not allowed you can still resort to the traditional use of concrete septic tank or you can buy prefabricated concrete tank to be lowered by a backhoe.



Concrete Septic Tank Schematic

## **Lastly. Inspection and Sign-off**

Staged inspections through the build with contractor and building official - foundation, plumbing and electrical, architectural, and fire.

Put together final check/punch list for contractor

Review punch list with contractor

Final inspection with building official for certificate of occupancy

# 36 Container House Designs

























































#### About Warren Thatcher

Warren Thatcher has been a leading and experienced professional container builder who has been offering the best quality services to his clients for 14 years. Being a professional builder and an expert designer Warren Thatcher has been passionate to build robust and brilliant designs of container homes. The expert container decided to come up with a brilliant guide book considering the surge in interest of people in shipping container homes. People have started realizing huge benefits of container homes and hence prefer to get the container homes built by the expert.

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**END**

# Build a Container Home

